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Review

The role of conformational traits on dairy cattle production in Gondar town, Ethiopia

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The study was conducted in dairy cattle farms, Gondar town from February 2015 to May 2015 to assess the contributions of conformation traits, to describe the selection criteria of dairy cattle production. Simple random sampling technique was used to select the respondents of the farm. Whereas, purposive sampling was used to select Kebeles based on dairy cattle potential. Therefore our work revealed that the conformation traits are influencing the milk yield of dairy cows in terms of negative and positive consequences with the Pearson's correlation coefficient of udder length (r=0.63), teat length (r= 0.53), body length (r=0.65) and heart girth (0.58). From the qualitative traits, about 53.34% of the interviewed dairy farm owners stated that the udder size and teat placement was considered to the main trait preference for the selection of dairy cows. Whereas normal feet and good leg conformation and attractive color was another additional traits which covered about 20% and 13.33% respectively followed by good milk yield capacity of the cows. The three different production systems effect on the performance of the cows were significantly (P<0.05) varied among the management aspects. Such as intensive production system on linear body measurement on body weight is significantly (573.64kg) heavier than the body weight of traditional production systems (533.5kg). Finally, measurable traits are strongly, positively and negatively affect the performance of dairy cows mainly conformation traits in relation with milk yield of the dairy cattle.

Key words: Conformation traits, dairy cattle, milk yield.

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INTRODUCTION

Ethiopia takes the lead in livestock population and gets way of domestic animal migration from Asia to Africa (CSA, 2012). From the total animal population livestock includes cattle, sheep and goat, poultry and power animals. These animal populations contributed for poverty alleviation by generating additional cash income. Due to this importance, most of all rural and some peri-urban farmers are keeping small animal population. Therefore Ethiopia has large animal population that possesses about 53, 25, 22 and 49.3 million heads of cattle, sheep, goat and poultry species, respectively (CSA, 2012). Despite these, large numbers of animal populations are prevailing for adapting the harsh environmental condition. However, these local animal genetic resources are characterized by poor in both production and reproductive performances like milk production and products (Felleke, 2003).

In Ethiopia some conformation traits are traditionally in used by smallholder farmers to select best dairy cows (Zewdu *et al*., 2006). Pure size traits, such as stature and heart girth, are closely related to body weights (Mantysaari,1996) , which are important functional traits regulating feed efficiency and energy balance traits in dairy cattle (Lin *et al*., 1987). Feed efficiency and energy

balance traits in turn are key traits for the biological and economic efficiency of dairy cattle production (Koenen, 2001).

The relationships among body conformation measurements of dairy cows represent a special interest to the dairy industry. Most of the dairy farmers usually judge the merits of dairy cows, to a certain extent, on the basis of body conformation. Brum and Ludwick (1999) found that measurements of body capacity such as body length, heart girth and withers height were related to milk production. Rogers *et al*. (1981) found that udder depth and teat rear view were the traits most related to survival. Selection based on body measurements and milk production could result in a greater genetic gain in milk yield than single selection for milk yield.

Milk production of dairy cows becomes the important trait among selection criteria, which have tight connection to economic effectiveness of dairy cattle production (Meszaros *et al*., (2008). Despite this, dairy cow survival is influenced by many genetic and non-genetic factors. Non-genetic factors include the housing type, milk quota restrictions and the availability of replacement heifers. Genetic factors include the capability for high production and desirable milk components, the functional conformation necessary for a cow to express her potential to give high milk yield and the ability to maintain adequate body condition to resist metabolic disorders, and the ability to move with sound locomotion (Atkins *et al*., 2008). This study gathered main information on the contribution of conformation traits on dairy cattle production and their effects to milk yield of cows in Gondar town, North Gondar of Amhara Regional State. This study also improves dairy farm owners to use best dairy cows by encouraging best selection criteria of the dairy cows as well to improve milk yield. The objective of the study was to assess the contributions of conformation traits and to describe selection criteria's of dairy cattle production in Gondar town.

LITERATURE REVIEW

Uses of conformation traits on dairy cattle production

The dairy industry faces unique challenges to constantly improve functionality of the dairy cow to meet the needs of future production and reproduction demands. Today's classification program focuses on a comprehensive set of descriptive traits that describe the animal's strengths and weaknesses and that collectively depict overall functionality. Since conformation traits are heritable and have been shown to be linked with functionality, selection for conformational traits is an effective tool to increase milk yield and facilitate genetic improvement of dairy cattle in functionality (Atkins *et al*., 2008).

Conformation traits as a selection criteria

Sound decision-making is dependent on superior cow sense and good conformation trait appearances (Atkins *et al*., 2008). Genetic change and hopefully improvement takes place when the parents of the next generation of animals are chosen. For a dairy herd, that means choosing the sires and dams of potential heifer replacements and doing so on the basis of their expected genetic merit. The information necessary in making the selection decisions on which sires and dams will be the parents of the next generation of heifer replacements. It would be advisable to restrict selection criteria for dairy cattle on milk production, fat and protein yield, feet and legs, udders, capacity, dairyness. Each of these selection criteria will be analyzed separately. For instance, collectively selection for these six characteristics would go a long way to ensuring more productive dairy cows in South Africa (John, 2005).

Zewdu (2004) and Fasil (2006) have both shown that selection criteria relevant to milk production potential were included bigger size of the udder and teat, pedigree history of the animal indicating inheritance from a known high producer as recalled by owner, well attached udder and squarely placed teats. Related conformation traits include wide hindquarter, long and thin tail, longer naval flap, thin and long neck, concave face, reduced hump, attractive appearance, drooping vulva (for easiness of calving), bushy tail end, thick skin (to withstand the infliction of biting flies) and big body size (Table 1). Other relevant traits include temperament, non-black hair coat, better growth rate; good mothering ability and being in good health condition also take in mind (Taye, 2005). Kelay, (2002) also reported that the important conformation traits such as straight back and large udder of the cows is the main selection criteria to select the dairy cows.

As a basis of judgment to dairy cattle

Judgment of dairy cattle takes placed depending on the different types of conformation traits. Judging dairy cattle is a comparative evaluation of cattle in which animals are ranked based on their closeness to the ideal dairy conformation. Desirable dairy conformation involves functional traits associated with high milk production over a long and trouble free productive life. In addition to learning how to judge cattle, many life skills are gained through the dairy judging experience. In order to judge dairy cattle, knowing the parts of a cow, ideal dairy

Table 1. Reported farmers' selection practices of local dairy cattle for milk production in Amhara Region.

Cattle type	Location	Phenotypic selection criteria of dairy cattle	Reference
Fogera cattle	Dera and fogera districts of south Gondar zone,	Large udder, medium or long body, pelvic width and large navel flap	Zewdu, 2004
Wogera cattle	Debark ,Dabat and Wogera	Mothering ability and fertility	
Dembia cattle	Dembia, Gondar zuria, chilga and Alfatakusa	Long navel flap, wide pelvic, long neck, medium to large udder, and balanced teats, and medium tail length	
Semein cattle	Beyeda and Janamora districts	Wide pelvic width, long and thin neck, long height and udder size	
Mahbere-Slassie composit	Orthodox Christian monastery	Good milk yield and mothering ability, and large body size	
Gojjam Highland zebu	Gozamen, Ankasha and Enemay	Coat color, parent history, temperament and udder size	Fasil, 2006

conformation, and how to describe differences between dairy cattle's will provide us with the necessary tools to place classes. In addition, good judges of dairy cattle need a definite mental image of the ideal dairy cattle for the breed being judged. This image can be developed by observing the body conformations of cattle as shown, visiting outstanding herds, studying breed journals, and observing personally-owned dairy cattle closely (Seykora and Hanson, 2000). The Purebred Dairy Cattle Association (PDCA) in USA for Holstein cows developed a score card that describes ideal dairy conformation that focuses and evaluating five major categories are frame, dairy character, body capacity, feet and legs, and udder (Seykora and Hanson, 2000). Surprisingly, there is no clear indigenous dairy cattle judgment criteria based on the morphological appearance (body conformation) of the cows in Ethiopia. These cows has small head size and, almost all the farmers considered a cow as best for milk production if it has a straight back, triangular shape of the frame of a cow and straightness of the back of the cow and large udder of the cow (Belihu,2002).

Conformation traits as indicators of milk yield

Conformation traits are identified as important predictors of milk estimated breeding values, if they are measured early in life before milk estimated breeding values are computed, and if these predictors have no known negative side-effects on cows' profitability, then those conformation traits could be used for mating decision-making. Indeed, dairy producers are usually able to evaluate their cows' conformation. This information could then be used before milk estimated breeding values are available, or when they are not available (Detilleux and Leroy, 1999).

Improve the reliability of genetic evaluation to dairy cattle

Generally, the reliability of genetic evaluation is defined as a squared correlation between the true and the estimated breeding value of an animal. Methods that use both direct information on herd's life and indirect information obtained from conformation traits have recently been developed by (Weigel *et al*., 1998). Both information sources are combined into one index after being appropriately weighted depending on reliability and genetic covariance's between conformation traits and herd life. The procedure that combines the direct information on herd life from a survival analysis with the indirect information derived from breeding values for conformation traits is computationally simple and can be applied to any dairy cow that has conformation proofs. The reliability of the combined evaluation is always higher than the reliability of the direct evaluation alone (Vukasinovic *et al.,* 2002).

The effect of conformation traits on the production of dairy cattle

The consistent dairy improvement in physical conformation and a significant proportion of genetic variation in production life remains unexplained by existing type or production traits. More recently, emphasis on tall and large frames has been directed more to a focus on an angular, open and well-sprung rib accompanied by a wide chest and sufficient depth of

body to provide the functionality necessary to consistently produce large amounts of milk. Sufficient stature is still required to achieve the necessary balance with a desirable skeletal frame that provides the strength to support a strong loin and a properly sloped rump (Atkins *et al*., 2008).

The rump is also represents the prominences of the pelvis and its importance in feet and leg structure, udder width and attachment, as well as calving ease cannot be overestimated. A strongly attached and well-balanced udder with fine texture will support high and persistent production over the cow's lifetime (Atkins *et al*., 2008). Generally, the functional conformation traits that influences or facilitates to the productive life and reproduction status of dairy cows are classified in to four groups. These are udder conformation, feet and leg conformation, thoracic and abdominal body conformation, and rump and loin structure.

Udder conformation

Udder conformation should include a detailed description of the udder's suspensor apparatus since the attachment of udder to the ventral abdominal wall and the pelvic floor is fundamental to udder health to contribute milk yield (Atkins *et al*., 2008). The udder's exterior form and location depend on the development and strength of its suspensor apparatus which is responsible for the attachment of the udder to the ventral abdominal wall and the pelvic floor.

Feet and leg conformation

Locomotion is a qualitative observation of a dairy cow's ability to walk normally. It should evaluate the cow's conformation, her freedom from lameness, and the desirability of the surface upon which she walks. Scoring locomotion directly is the most accurate determination of a cow's feet and leg soundness.

In addition to evaluating the magnitude of lameness, locomotion scoring has been initiated in several countries as part of the type classification system. Locomotion evaluation involves observing a cow while walking and identifying important parameter including foot placement. Normal locomotion is characterized by a long fluid stride where the rear foot falls into the position vacated by the front foot on the same side (no abduction or overlap). Undesirable locomotion may result in the rear foot being placed outside the imprint of the front foot as well as a reduction in the stride length, and a decrease in step angle and walking speed (Telezhenko, 2002). The estimated heritability of feet and leg traits is low, ranging from 0.08 to 0.30 (Kistemaker and Huapaya., 2006), however, the most influential type trait on profit, after adjusting for production, was shown to be Feet and Legs (Perez and Alenda., 2002). This association can be attributed to the positive influence that sound feet and legs can have on production of milk and reproduction. A favorable genetic correlation was estimated between Feet and Legs and non-return rate, suggesting that cows with good feet and legs were less likely to return to service (Wall *et al*., 2005). Melendez *et al*. (2003) explained that cows having foot and leg problems were less likely to show signs of estrous. Sewalem *et al*. (2004) reported that cows having extremely course bones, extremely shallow heels, low foot angle, and extremely straight or curved legs from the side view had decreased functional productive life.

Thoracic and abdominal body conformation

Thoracic and abdominal capacity along with dairyness and feminity (angularity) are desirable attributes to facilitate the dairy cows ability to process large volumes of roughage and sustain high milk production and desirable reproductive performance (Atkins *et al*., 2008). The relationship between body condition and reproductive performance are also well documented.

Rump and loin structure

A dairy cow's rump and loin structure fasten the cow's abdominal and lumbar regions to her feet and legs and mammary system. Without adequate strength in this area, the productive life of a cow will be seriously compromised (Atkins *et al*., 2008). Absence of abnormalities such as advanced anus, advanced tail head, and recessed tail head are desired so that fertility is not negatively affected. Higher pin bones are associated with an undesirable tilt to the vaginal canal causing it to lie at an inward sloping angle rather than lying flat. With this type of angle, the reproductive tract is more prone to infection because the vagina is unable to drain effectively (Astis *et al*., 2002). Research shows that animals with higher pin bones and narrower rumps are more likely to have difficult calving (Hansen *et al*., 1999). Animals with intermediate rump angles had a longer productive life (lower rate of culling) than animals with extremely low or extremely high pin bones in relation to hip bones (Perez and Alenda, 2002). Sewalem *et al. (2004)* showed that the relative risk of involuntary rump angles culling was lowest.

Relations between production and body conformation traits

The indirect selection of dairy cow is the application of the correlated trait which shows the potential of the individual and is related to its survival in the herd. From the main and partial body conformational traits were regarded. The cows with sound conformation of the normal legs and feet can give good milk yield. Longer productive life in cows with a correct rear leg set in all husbandry systems and found low or moderate genetic correlations of rear leg posture (r = 0.35), foot angle (r = 0.25) and fetlock (r = 0.21) in Brown Swiss cattle (Vukasinovic *et al*., 2002). Vukasinovic *et al.* (2002) found significant genetic correlations between milk production and the evaluation of the udder and the teats (r ranged from 0.38 to 0.66).

CONCLUSION AND RECOMMENDATION

The study result indicated that dairy cattle production was the main activities and main sources of immediate cash incomes and conformation traits are contributed to predict milk yield of the dairy cattle in the study area. It is usual in better production systems since intensive production system showed best in milk yield than the others. Therefore, conformation traits were important to dairy farm owners in which they usually use to judge the merit of dairy cows. The selection criteria of dairy cows were also accompanied by the measurements and observations of the different conformation traits. These traits were also best indicators of milk yield. In addition to, the selection of good locomotion, feet and leg conformation has also important role to play in long term reduction of lameness levels and careful consideration as part of the overall dairy improvement programs. Finally, the conformation traits like udder length, heart girth, and body length was contributed to dairy cattle milk yield prediction.

Based on the aforementioned findings the following recommendations are forwarded:

i. The ongoing activities to improve and expand dairy cattle production and the selection criteria of dairy cow on categorical traits should be replaced by linier body measurment

ii. In addition to prediction model estimation of milk yield based on linear body measurement data recording is important for the selection of individuals to know the genetic value.

iii. To improve the milk production of dairy cattle performance evaluation based on different production system needs further monitoring.

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